Pharmacologic Product Guide: FDA-Approved Medications for Smoking Cessation

	Nicotine Replacement Therapy (NRT) Formulations				Bupropion SR	Varenicline
	Gum	**Lozenge**	**Transdermal Patch**	**Nasal Spray**		
Product	**Nicorette[1], Generic** OTC 2 mg, 4 mg original, cinnamon, fruit, mint (various)	**Nicorette[1], Generic; Nicorette[1] Mini** OTC 2 mg, 4 mg; cinnamon, cherry, mint	**Habitrol[2], NicoDerm CQ[1], Generic** OTC 7 mg, 14 mg, 21 mg (24-hr release)	**Nicotrol NS[3]** Rx Metered spray 10 mg/mL nicotine solution	**Generic** (formerly Zyban) Rx 150 mg sustained-release tablet	**Generic** (formerly Chantix[3]) Rx 0.5 mg, 1 mg tablet
Precautions	▪ Recent (≤ 2 weeks) myocardial infarction ▪ Serious underlying arrhythmias ▪ Serious or worsening angina pectoris ▪ Temporomandibular joint disease ▪ Pregnancy[4] and breastfeeding ▪ Adolescents (<18 years)	▪ Recent (≤ 2 weeks) myocardial infarction ▪ Serious underlying arrhythmias ▪ Serious or worsening angina pectoris ▪ Pregnancy[4] and breastfeeding ▪ Adolescents (<18 years)	▪ Recent (≤ 2 weeks) myocardial infarction ▪ Serious underlying arrhythmias ▪ Serious or worsening angina pectoris ▪ Pregnancy[4] and breastfeeding ▪ Adolescents (<18 years)	▪ Recent (≤ 2 weeks) myocardial infarction ▪ Serious underlying arrhythmias ▪ Serious or worsening angina pectoris ▪ Underlying chronic nasal disorders (rhinitis, nasal polyps, sinusitis) ▪ Severe reactive airway disease ▪ Pregnancy[4] and breastfeeding ▪ Adolescents (<18 years)	▪ Concomitant therapy with medications/conditions known to lower the seizure threshold ▪ Hepatic impairment ▪ Pregnancy[4] and breastfeeding ▪ Adolescents (<18 years) ▪ Treatment-emergent neuropsychiatric symptoms[5] **Contraindications:** ▪ Seizure disorder ▪ Concomitant bupropion (e.g., Wellbutrin) therapy ▪ Current or prior diagnosis of bulimia or anorexia nervosa ▪ Simultaneous abrupt discontinuation of alcohol or sedatives/benzodiazepines ▪ MAO inhibitors in preceding 14 days; concurrent use of reversible MAO inhibitors	▪ Severe renal impairment (dosage adjustment is necessary) ▪ Pregnancy[4] and breastfeeding ▪ Adolescents (<18 years) ▪ Treatment-emergent neuropsychiatric symptoms[5]
Dosing	*1st cigarette ≤30 minutes after waking:* 4 mg *1st cigarette >30 minutes after waking:* 2 mg Weeks 1–6: 1 piece q 1–2 hours* Weeks 7–9: 1 piece q 2–4 hours* Weeks 10–12: 1 piece q 4–8 hours* **while awake* ▪ Maximum, 24 pieces/day ▪ During initial 6 weeks of treatment, use at least 9 pieces/day ▪ Chew each piece slowly ▪ Park between cheek and gum when peppery or tingling sensation appears (~15–30 chews) ▪ Resume chewing when tingle fades ▪ Repeat chew/park steps until most of the nicotine is gone (tingle does not return; generally 30 min) ▪ Park in different areas of mouth ▪ No food or beverages 15 minutes before or during use ▪ Duration: up to 12 weeks	*1st cigarette ≤30 minutes after waking:* 4 mg *1st cigarette >30 minutes after waking:* 2 mg Weeks 1–6: 1 lozenge q 1–2 hours* Weeks 7–9: 1 lozenge q 2–4 hours* Weeks 10–12: 1 lozenge q 4–8 hours* **while awake* ▪ Maximum, 20 lozenges/day ▪ During initial 6 weeks of treatment, use at least 9 lozenges/day ▪ Allow to dissolve slowly (20–30 minutes) ▪ Nicotine release may cause a warm, tingling sensation ▪ Do not chew or swallow ▪ Occasionally rotate to different areas of the mouth ▪ No food or beverages 15 minutes before or during use ▪ Duration: up to 12 weeks	*>10 cigarettes/day:* 21 mg/day x 4–6 weeks 14 mg/day x 2 weeks 7 mg/day x 2 weeks *≤10 cigarettes/day:* 14 mg/day x 6 weeks 7 mg/day x 2 weeks ▪ Rotate patch application site daily; do not apply a new patch to the same skin site for at least one week ▪ May wear patch for 16 hours if patient experiences sleep disturbances (remove at bedtime); before recommending, rule out other factors that might be contributing (e.g., drug interaction between caffeine and tobacco smoke, other medications, and lifestyle factors) ▪ Duration: 8–10 weeks	1–2 doses/hour* (8–40 doses/day) One dose = 2 sprays (one in **each** nostril); each spray delivers 0.5 mg of nicotine to the nasal mucosa **while awake* ▪ Maximum – 5 doses/hour or – 40 doses/day ▪ During intial 6-8 weeks of treatment, use at least 8 doses/day ▪ Gradually reduce daily dosage over an additional 4-6 weeks ▪ Do not sniff, swallow, or inhale through the nose as the spray is being administered ▪ Duration: 12 weeks	150 mg po q AM x 3 days, then 150 mg po bid ▪ Do not exceed 300 mg/day ▪ Begin therapy 1–2 weeks **prior** to quit date ▪ Allow at least 8 hours between doses ▪ Avoid bedtime dosing to minimize insomnia ▪ Duration: 7–12 weeks, with maintenance up to 6 months in selected patients ▪ Dose tapering is not necessary	Days 1–3: 0.5 mg po q AM Days 4–7: 0.5 mg po bid Weeks 2–12: 1 mg po bid ▪ Begin therapy 1 week **prior** to quit date ▪ Take each dose after eating and with a full glass of water ▪ Dosing adjustment is necessary for patients with severe renal impairment ▪ Duration: 12 weeks; an additional 12-week course may be used in selected patients ▪ May initiate up to 35 days before target quit date OR may reduce smoking over a 12-week period of treatment prior to quitting and continue treatment for an additional 12 weeks

	Nicotine Replacement Therapy (NRT) Formulations				Bupropion SR	Varenicline
	Gum	Lozenge	Transdermal Patch	Nasal Spray		
Adverse Effects	▪ Mouth and throat irritation ▪ Jaw muscle soreness ▪ Hiccups ▪ GI complaints (dyspepsia, nausea) ▪ May stick to dental work ▪ Adverse effects more commonly experienced when chewing the lozenge or using incorrect gum chewing technique (due to rapid nicotine release): – Lightheadedness/dizziness – Nausea/vomiting – Hiccups – Mouth and throat irritation	▪ Mouth and throat irritation ▪ Hiccups ▪ GI complaints (dyspepsia, nausea)	▪ Local skin reactions (erythema, pruritus, burning) ▪ Sleep disturbances (abnormal or vivid dreams, insomnia); associated with nocturnal nicotine absorption	▪ Nasal and/or throat irritation (hot, peppery, or burning sensation) ▪ Ocular irritation/tearing ▪ Sneezing ▪ Cough	▪ Insomnia ▪ Dry mouth ▪ Nausea ▪ Anxiety/difficulty concentrating ▪ Constipation ▪ Tremor ▪ Rash ▪ Seizures (risk is 0.15%) ▪ Neuropsychiatric symptoms (rare; see Precautions)	▪ Nausea ▪ Sleep disturbances (insomnia, abnormal/vivid dreams) ▪ Headache ▪ Flatulence ▪ Constipation ▪ Taste alteration ▪ Neuropsychiatric symptoms (rare; see Precautions)
Advantages	▪ Might serve as an oral substitute for tobacco ▪ Might delay weight gain ▪ Can be titrated to manage withdrawal symptoms ▪ Can be used in combination with other agents to manage situational urges ▪ Relatively inexpensive	▪ Might serve as an oral substitute for tobacco ▪ Might delay weight gain ▪ Can be titrated to manage withdrawal symptoms ▪ Can be used in combination with other agents to manage situational urges ▪ Relatively inexpensive	▪ Once-daily dosing associated with fewer adherence problems ▪ Of all NRT products, its use is least obvious to others ▪ Can be used in combination with other agents; delivers consistent nicotine levels over 24 hours ▪ Relatively inexpensive	▪ Can be titrated to rapidly manage withdrawal symptoms ▪ Can be used in combination with other agents to manage situational urges	▪ Twice-daily oral dosing is simple and associated with fewer adherence problems ▪ Might delay weight gain ▪ Might be beneficial in patients with depression ▪ Can be used in combination with NRT agents ▪ Relatively inexpensive (generic formulations)	▪ Twice-daily oral dosing is simple and associated with fewer adherence problems ▪ Offers a different mechanism of action for patients who have failed other agents ▪ Most effective cessation agent when used as monotherapy
Disadvantages	▪ Need for frequent dosing can compromise adherence ▪ Might be problematic for patients with significant dental work ▪ Proper chewing technique is necessary for effectiveness and to minimize adverse effects ▪ Gum chewing might not be acceptable or desirable for some patients	▪ Need for frequent dosing can compromise adherence ▪ Gastrointestinal side effects (nausea, hiccups, heartburn) might be bothersome	▪ When used as monotherapy, cannot be titrated to acutely manage withdrawal symptoms ▪ Not recommended for use by patients with dermatologic conditions (e.g., psoriasis, eczema, atopic dermatitis)	▪ Need for frequent dosing can compromise adherence ▪ Nasal administration might not be acceptable or desirable for some patients; nasal irritation often problematic ▪ Not recommended for use by patients with chronic nasal disorders or severe reactive airway disease ▪ Cost of treatment	▪ Seizure risk is increased ▪ Several contraindications and precautions preclude use in some patients (see Precautions) ▪ Patients should be monitored for potential neuropsychiatric symptoms[5] (see Precautions)	▪ Patients should be monitored for potential neuropsychiatric symptoms[5] (see Precautions) ▪ Cost of treatment
Cost/day[6]	2 mg or 4 mg: $2.52–$3.42 (9 pieces)	2 mg or 4 mg: $3.42–$3.87 (9 pieces)	$1.82–$2.61 (1 patch)	$10.63 (8 doses)	$0.54 (2 tablets)	$11.18 (2 tablets)

[1] Marketed by GlaxoSmithKline.
[2] Marketed by Dr. Reddy's.
[3] Marketed by Pfizer. Chantix (0.5 mg and 1 mg tablets), formerly marketed by Pfizer, were voluntarily recalled (unavailable since 9/16/2021) due to the presence of N-nitroso-varenicline at or above the FDA acceptable intake limit. Alternative suppliers have been approved for generic formulations in the US.
[4] The U.S. Clinical Practice Guideline states that pregnant smokers should be encouraged to quit without medication based on insufficient evidence of effectiveness and theoretical concerns with safety. Pregnant tobacco users should be offered behavioral counseling interventions that exceed minimal advice to quit.
[5] In July 2009, the FDA mandated that the prescribing information for all bupropion- and varenicline-containing products include a boxed warning highlighting the risk of serious neuropsychiatric symptoms, including changes in behavior, hostility, agitation, depressed mood, suicidal thoughts and behavior, and attempted suicide. Clinicians should advise patients to stop taking varenicline or bupropion SR and contact a health care provider immediately if they experience agitation, depressed mood, or any changes in behavior that are not typical of nicotine withdrawal, or if they experience suicidal thoughts or behavior. If treatment is stopped due to neuropsychiatric symptoms, patients should be monitored until the symptoms resolve. Based on results of a mandated clinical trial, the FDA removed this boxed warning in December 2016.
[6] Approximate cost based on the recommended initial dosing for each agent and average wholesale acquisition prices for generic and brand formulations from Red Book Online. Thomson Reuters, January 2024.

Abbreviations: MAO, monoamine oxidase; NRT, nicotine replacement therapy; OTC, over-the-counter (nonprescription product); Rx, prescription product.

For complete prescribing information and a comprehensive listing of warnings and precautions, please refer to the manufacturers' package inserts.

DRUG INTERACTIONS WITH TOBACCO SMOKE

Many interactions between tobacco smoke and medications have been identified. Note that in most cases it is the tobacco smoke—not the nicotine—that causes these drug interactions. Tobacco smoke interacts with medications through pharmacokinetic (PK) and pharmacodynamic (PD) mechanisms. PK interactions affect the absorption, distribution, metabolism, or elimination of other drugs, potentially causing an altered pharmacologic response. The majority of PK interactions with smoking are the result of induction of hepatic cytochrome P450 enzymes (primarily CYP1A2). Smokers may require higher doses of medications that are CYP1A2 substrates. Upon cessation, dose reductions might be needed. PD interactions alter the expected response or actions of other drugs. The amount of tobacco smoking needed to have an effect has not been established, and the assumption is that any smoker is susceptible to the same degree of interaction. **The most clinically significant interactions are depicted in the shaded rows.**

DRUG/CLASS	MECHANISM OF INTERACTION AND EFFECTS
Pharmacokinetic Interactions	
Alprazolam (Xanax®)	▪ Conflicting data on significance, but possible ↓ plasma concentrations (up to 50%); ↓ half-life (35%).
Bendamustine (Treanda®)	▪ Metabolized by CYP1A2. Manufacturer recommends using with caution in smokers due to likely ↓ bendamustine concentrations, with ↑ concentrations of its two active metabolites.
Caffeine	▪ ↑ Metabolism (induction of CYP1A2); ↑ clearance (56%). Caffeine levels likely ↑ after cessation.
Chlorpromazine (Thorazine®)	▪ ↓ Area under the curve (AUC) (36%) and serum concentrations (24%). ▪ ↓ Sedation and hypotension possible in smokers; smokers may require ↑ dosages.
Clopidogrel (Plavix®)	▪ ↑ Metabolism (induction of CYP1A2) of clopidogrel to its active metabolite. ▪ Enhanced response to clopidogrel in smokers (≥10 cigarettes/day): ↑ platelet inhibition, ↓ platelet aggregation; improved clinical outcomes have been shown (smokers' paradox; may be dependent on CYP1A2 genotype); tobacco cessation should still be recommended in at-risk populations needing clopidogrel.
Clozapine (Clozaril®)	▪ ↑ Metabolism (induction of CYP1A2); ↓ plasma concentrations (by 18%). ▪ ↑ Levels upon cessation may occur; closely monitor drug levels and reduce dose as required to avoid toxicity.
Erlotinib (Tarceva®)	▪ ↑ Clearance (24%); ↓ trough serum concentrations (2-fold).
Flecainide (Tambocor®)	▪ ↑ Clearance (61%); ↓ trough serum concentrations (25%). ▪ Smokers may need ↑ dosages.
Fluvoxamine (Luvox®)	▪ ↑ Metabolism (induction of CYP1A2); ↑ clearance (24%); ↓ AUC (31%); ↓ Cmax (32%) and Css (39%). ▪ Dosage modifications not routinely recommended but smokers may need ↑ dosages.
Haloperidol (Haldol®)	▪ ↑ Clearance (44%); ↓ serum concentrations (70%); data are inconsistent therefore clinical significance is unclear.
Heparin	▪ Mechanism unknown: ↑ clearance; ↓ half-life. Smoking has prothrombotic effects. ▪ Smokers may need ↑ dosages due to PK and PD interactions.
Insulin, subcutaneous	▪ Possible ↓ insulin absorption secondary to peripheral vasoconstriction. ▪ Smoking may cause release of endogenous substances that cause insulin resistance. ▪ PK & PD interactions likely not clinically significant, but smokers may need ↑ dosages.
Irinotecan (Camptosar®)	▪ ↑ Clearance (18%); ↓ serum concentrations of active metabolite, SN-38 (~40%; via induction of glucuronidation); ↓ systemic exposure resulting in lower hematologic toxicity and may reduce efficacy. ▪ Smokers may need ↑ dosages.
Methadone	▪ Possible ↑ metabolism (induction of CYP1A2, a minor pathway for methadone). ▪ Carefully monitor response upon cessation.
Mexiletine (Mexitil®)	▪ ↑ Clearance (25%; via oxidation and glucuronidation); ↓ half-life (36%).
Nintedanib (OFEV®)	▪ Decreased exposure (21%) in smokers. ▪ No dose adjustment recommended; however, patients should not smoke during use.

Pharmacokinetic Interactions (continued)	
DRUG/CLASS	**MECHANISM OF INTERACTION AND EFFECTS**
Olanzapine (Zyprexa®)	▪ ↑ Metabolism (induction of CYP1A2); ↑ clearance (98%); ↓ serum concentrations (12%). ▪ Dosage modifications not routinely recommended but smokers may need ↑ dosages.
Pirfenidone (Esbriet®)	▪ ↑ Metabolism (induction of CYP1A2); ↓ AUC (46%) and ↓ Cmax (68%). ▪ Decreased exposure in smokers might alter efficacy profile.
Propranolol (Inderal®)	▪ ↑ Clearance (77%; via side-chain oxidation and glucuronidation).
Riociguat (Adempas®)	▪ ↓ Plasma concentrations (by 50–60%). ▪ Smokers may require dosages higher than 2.5 mg three times a day; consider dose reduction upon cessation.
Ropinirole (Requip®)	▪ ↓ Cmax (30%) and ↓ AUC (38%) in study with patients with restless legs syndrome. ▪ Smokers may need ↑ dosages.
Tasimelteon (Hetlioz®)	▪ ↑ Metabolism (induction of CYP1A2); ↓ drug exposure (40%). ▪ Smokers may need ↑ dosages.
Theophylline (Theo-Dur®, etc.)	▪ ↑ Metabolism (induction of CYP1A2); ↑ clearance (58–100%); ↓ half-life (63%). ▪ Levels should be monitored if smoking is initiated, discontinued, or changed. Maintenance doses are considerably higher in smokers; ↑ clearance also with second-hand smoke exposure.
Tizanidine (Zanaflex®)	▪ ↓ AUC (30–40%) and ↓ half-life (10%) observed in male smokers.
Tricyclic antidepressants (e.g., imipramine, nortriptyline)	▪ Possible interaction with tricyclic antidepressants in the direction of ↓ blood levels, but the clinical significance is not established.
Warfarin	▪ ↑ Metabolism (induction of CYP1A2) of R-enantiomer; however, S-enantiomer is more potent and effect on INR is inconclusive. Consider monitoring INR upon smoking cessation.
Pharmacodynamic Interactions	
Benzodiazepines (diazepam, chlordiazepoxide)	▪ ↓ Sedation and drowsiness, possibly caused by nicotine stimulation of central nervous system.
Beta-blockers	▪ Less effective BP and heart rate control effects; possibly caused by nicotine-mediated sympathetic activation. ▪ Smokers may need ↑ dosages.
Corticosteroids, inhaled	▪ Smokers with asthma may have less of a response to inhaled corticosteroids.
Hormonal contraceptives (combined)	▪ ↑ Risk of cardiovascular adverse effects (e.g., stroke, myocardial infarction, thromboembolism) in women who smoke and use combined hormonal contraceptives. Ortho Evra patch users shown to have 2-fold ↑risk of venous thromboembolism compared with oral contraceptive users, likely due to ↑ estrogen exposure (60% higher levels). ▪ ↑ Risk with age and with heavy smoking (≥15 cigarettes per day) and is quite marked in women ≥35 years old.
Serotonin 5-HT_1 receptor agonists (triptans)	▪ This class of drugs may cause coronary vasospasm; caution for use in smokers due to possible unrecognized CAD.
Adapted and updated, from Zevin S, Benowitz NL. Drug interactions with tobacco smoking. An update. *Clin Pharmacokinet* 1999;36:425–38 and Kroon LA. Drug interactions with smoking. *Am J Health-Syst Pharm* 2007;64:1917–21.	